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PHYSICAL PROPERTIES OF ERUPTING SOLAR PROMINENCES

J. Lewis Fox and Roberto Casini

27 March 2013

Interim Report

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14. ABSTRACT Our goal is to determine the spectro-polarimetric properties of solar prominences leading to their activation and/or eruption into the interplanetary medium as coronal mass ejections (CMEs). This is accomplished by measuring the velocity and three-dimensional magnetic field of prominences using a new instrument, the Prominence Magnetometer (ProMag). This unique database will be used to study the structure and evolution of prominences, including their intimate interaction with the magnetic fields responsible for their support in the solar corona, until such time as they may erupt. The anticipated future result is the ability to predict the eruption of individual prominences and the following CMEs from the observable characteristics of the prominences. The impact of CMEs on geospace often produces severe space weather effects on Air Force systems. We have accomplished the successful construction, installation at the proposed research site, verification of the design concept and initial observations.				
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Physical Properties of Erupting Solar Prominences

AFOSR Lab Days, 27 Mar 2012

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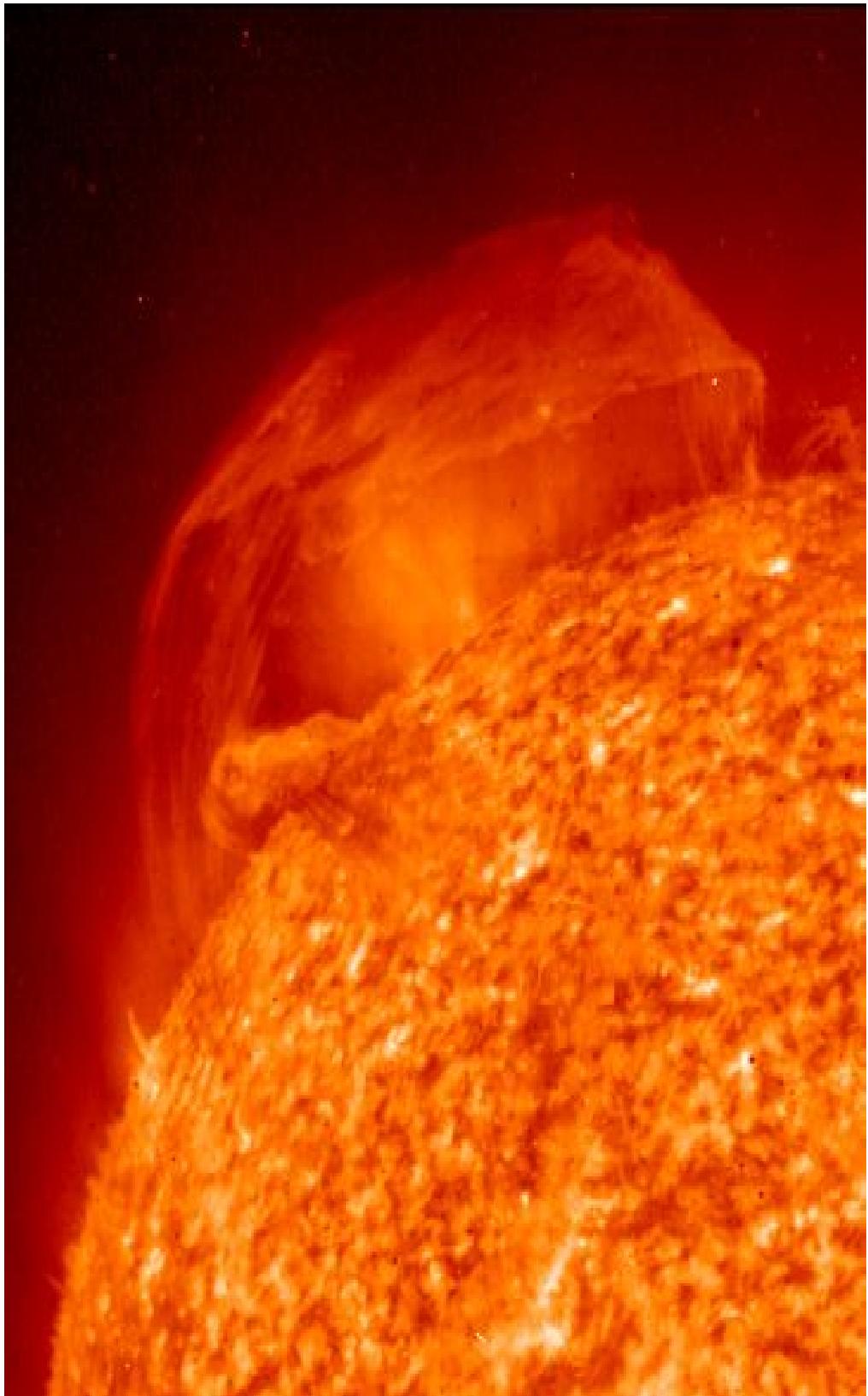
Abstract

Our goal is to determine the spectro-polarimetric properties of solar prominences leading to their activation and/or eruption into the interplanetary medium as coronal mass ejections (CMEs). This is accomplished by measuring the velocity and three-dimensional magnetic field of prominences using a new instrument, the Prominence Magnetometer (ProMag). This unique database will be used to study the structure and evolution of prominences, including their intimate interaction with the magnetic fields responsible for their support in the solar corona, until such time as they may erupt. The anticipated future result is the ability to predict the eruption of individual prominences and the following CMEs from the observable characteristics of the prominences. The impact of CMEs on geospace often produces severe space weather effects on Air Force systems. We have accomplished the successful construction, installation at the proposed research site, verification of the design concept and initial observations.

Introduction

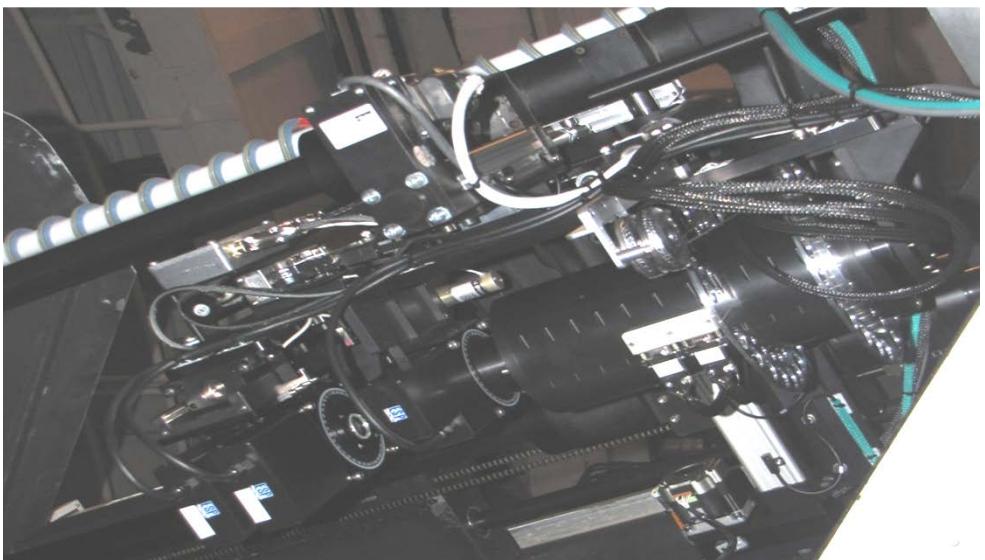
Solar prominences are aggregations of material in the solar corona of much higher density and much lower temperature than the corona. They are intimately connected with magnetic fields in the corona, which are rooted in the photosphere. At the current time, there is no agreement concerning their creation, how they are supported in the corona, magnetic fields, velocity fields, evolution and ultimate disappearance. We are attempting to provide answers to these questions through study of prominences using a new instrument, the Prominence Magnetometer (ProMag). This instrument was designed and constructed by the High Altitude Observatory (HAO) and installed in the John W. Evans Solar Facility (ESF).

A Prominence Observed by the SOHO Extreme Ultraviolet Imaging Telescope (EIT)



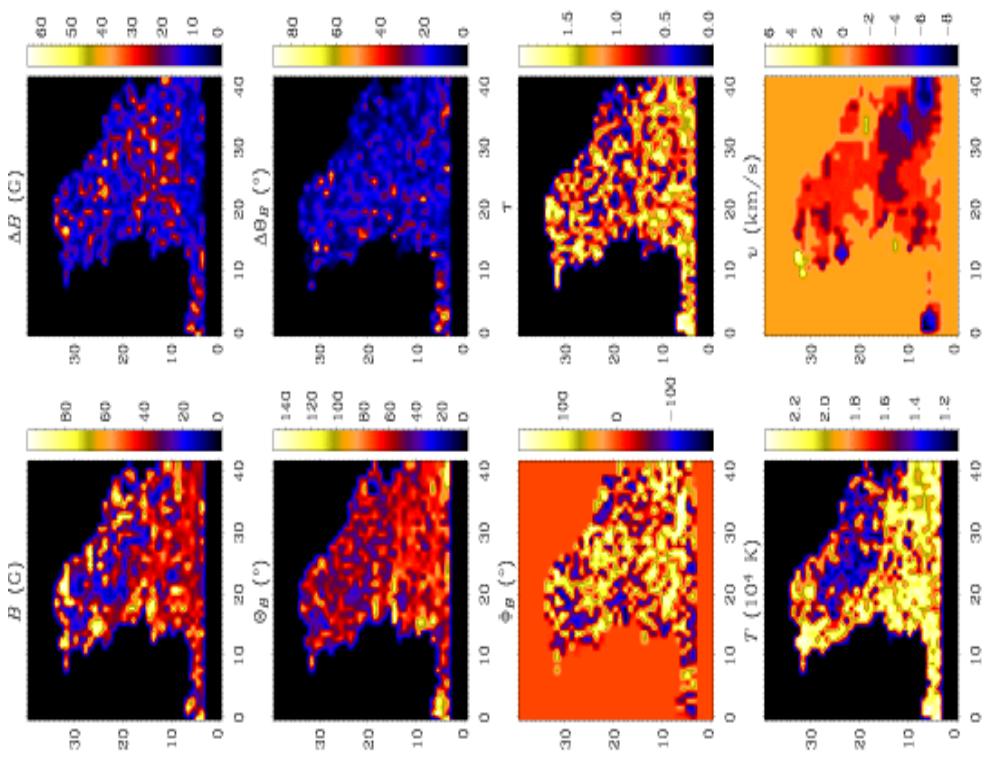
HAO Prominence Magnetometer (ProMag)

Polarization analyzer is an achromatic Ferroelectric Liquid Crystal modulator, previously situated inside the 40-cm coronagraph at NSO Sunspot. We are reconfiguring the instrument to perform analysis behind the entrance slit. This will improve polarimetric precision.

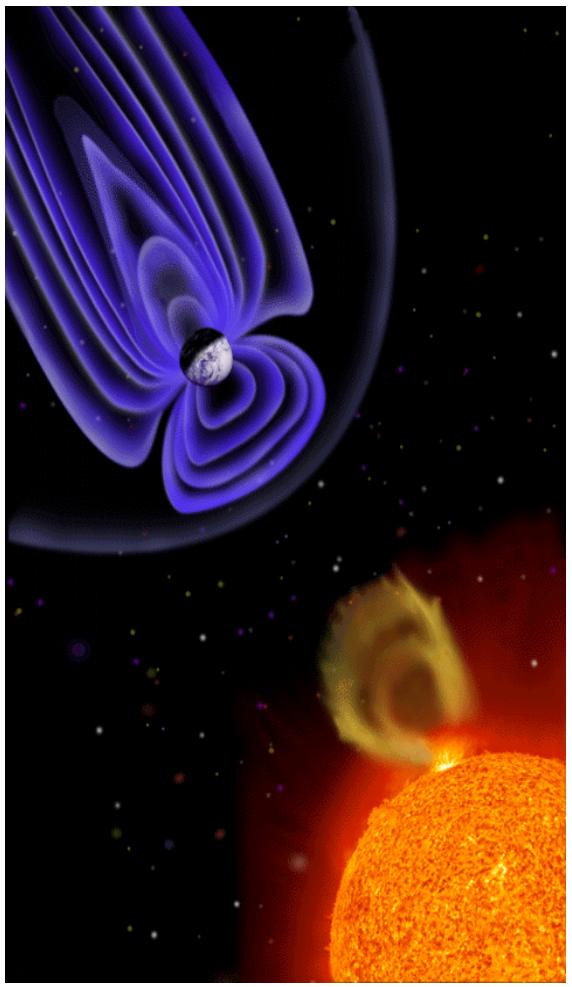


Prominence Magnetometer

Spectropolarimetry from **ProMag** will be used to derive the physical parameters of solar prominences in 3-D.



Expected outcome: Understanding of prominence eruptions that drive earthbound CMEs.



HAO Prominence Magnetometer

Spectropolarimetry from **ProMag** is used to derive physical parameters of solar prominences in 3-D.

Results: Progress made toward understanding of prominence eruptions that drive earthbound CMEs. Work continues with AFOSR Post-doctoral researcher Lewis Fox.

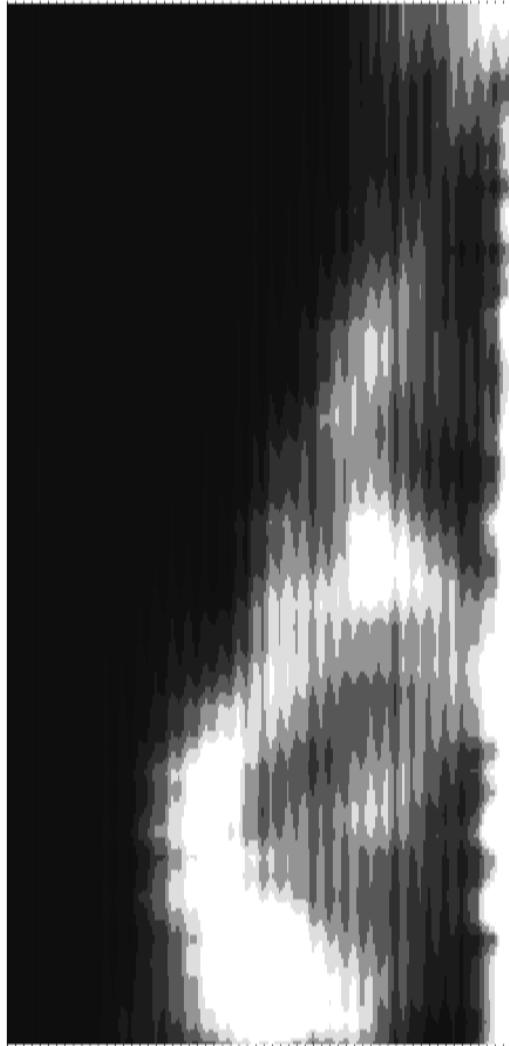
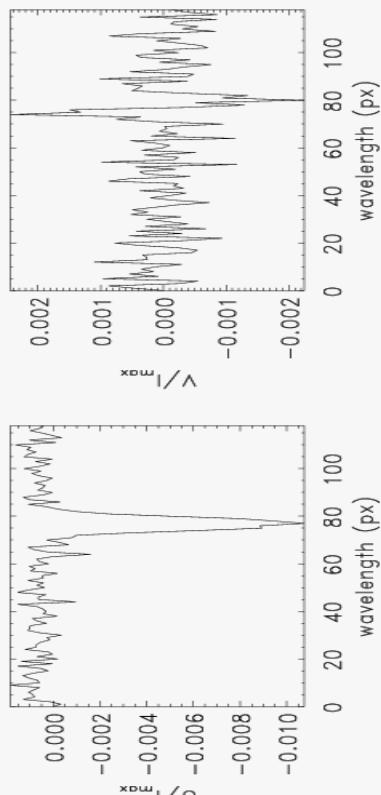
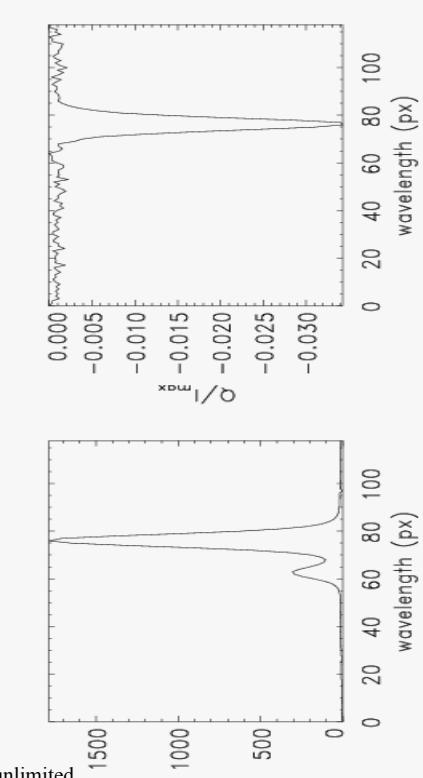


Image of a Prominence in He I 1083.0 nm made with ProMag



He I 1083.0 nm Stokes Magnetic Field Parameters I, Q, U and V observed with ProMag

Moving Forward

We have made substantial progress towards the goal of observing prominences and analyzing their physical processes. Instrument reconfiguration should allow sufficient numbers to be observed with sufficient precision to understand the destabilizing forces that result in CMEs. Observations continue.

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